

Patent Claims

Method for Measuring a Contour of a Workpiece by Scanning

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1. Method for measuring and/or capturing a contour and/or geometry of a workpiece by scanning while employing a first and a second sensor, characterized in that the contour and/or geometry of the workpiece is captured with the help of the at least two sensors and the information obtained from at least one sensor is used to influence at least one other sensor in its actions.

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2. Method pursuant to claim 1, characterized in that an image processing sensor is used as at least one sensor.

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3. Method pursuant to claim 1, characterized in that a feeler measuring upon contact is used as at least one sensor.

4. Method pursuant to claim 1, characterized in that a touchless distance sensor is used as at least one sensor.

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5. Method pursuant to claim 1, characterized in that a fiber-optic feeler is used as at least one of the sensors.

6. Method pursuant to at least one of the above claims, characterized in that at least one of the sensors is used to position at least one other sensor within its working area.

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7. Method pursuant to at least one of the above claims, characterized in that at least one of the sensors is used to avoid a collision of further participating sensors.

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8. Method pursuant to at least one of the above claims,
characterized in that
different illumination arrangements such as incident light or transmitted light are used
for at least one image processing sensor.
- 5 9. Method pursuant to at least one of the above claims,
characterized in that
when using an opto-tactile feeler with a feeler element, the scanning direction
required for the feeler element correction is generated from the information of a
further sensor.
- 10 10. Method pursuant to at least one of the above claims,
characterized in that
the scanning direction of one or the contact feeler required for the feeler element is
generated from information of another sensor.
- 15 11. Method pursuant to at least one of the above claims,
characterized in that
at least one image processing sensor is focused on the basis of a measuring reading
determined with a distance sensor.

12. Method pursuant to at least one of the above claims,
characterized in that
at least one image processing sensor is focused on the basis of a measuring reading
determined with a contact feeler.
- 5 13. Method pursuant to at least one of the above claims,
characterized in that
a scanning operation occurs within one step, wherein processing of the sensor
information is performed on-line.
- 10 14. Method pursuant to at least one of the above claims,
characterized in that
the scanning operation occurs in several individual steps, wherein processing of the
sensor information does not occur in line with scanning.
- 15 15. Method pursuant to at least one of the above claims,
characterized in that
first a contour in one plane is scanned using a sensor and the third coordinate to the
contour and/or plane or a contour offset thereto is captured using another sensor,
wherein the measuring points of the first contour define the travel paths.
- 20 16. Method pursuant to at least one of the above claims,
characterized in that
a scanning plane is defined a priori and a distance sensor is displaced in the plane
such that the distance value is a constant, wherein the method is not performed in the
direction of the axis of the sensor.
- 25 17. Method pursuant to at least one of the above claims,
characterized in that
the scanning operation or operations are performed on one or more coordinate
measuring devices.
- 30 18. Method pursuant to at least one of the above claims,
characterized in that
at least one of the sensors is an image processing sensor, in which the magnification
is modified.
19. Method pursuant to at least one of the above claims,

characterized in that

a combination of sensors is used, such as image processing with laser (distance measuring system) and/or image processing with contact feeler and/or image processing with fiber feeler and/or opto-tactile feeler and/or image processing with image processing in various resolutions and/or image processing with various views and/or image processing with different illumination types/adjustments and/or laser with contact feeler and/or laser with fiber feeler such as opto-tactile feeler and/or contact feeler with fiber feeler such as opto-tactile feeler and/or contact feeler with contact feeler with various feeler elements or sensitivity levels and/or fiber feeler with fiber feeler with various feeler elements or sensitivity levels.

20. Method pursuant to preferably at least one of the above claims for measuring a contour of a workpiece by scanning,

characterized in that

the contour is measured in an opto-tactile manner by means of a feeler that is moved along said contour and an optical sensor assigned thereto and that the movement of the feeler along the contour is controlled by means of an image processing sensor.

21. Method pursuant to claim 20,

characterized in that

both the measuring readings of an opto-tactile feeler and those of an image processing sensor are used to measure the workpiece contour by scanning.

22. Method pursuant to at least one of the above claims,
characterized in that
the measuring operation is performed on a coordinate measuring device.

23. Method pursuant to at least one of the above claims,
characterized in that
the regulation of the scanning operation of the coordinate measuring device is
implemented via the image processing sensor and the capturing of the measuring
points via an opto-tactile feeler.

24. Method pursuant to at least one of the above claims,
characterized in that
the same image processing optics and/or camera and/or electronics are used for
tracing the contour with the image processing sensor and for measuring the
measuring points with the opto-tactile feeler.

25. Method pursuant to at least one of the above claims,
characterized in that
a separate optical beam path is used for tracing the contour with the image
processing sensor.

26. Method pursuant to at least one of the above claims,
characterized in that
the image processing sensor and opto-tactile sensor are integrated such in an optical
beam path that for both sensors adjusted different magnification levels are achieved.

27. Method pursuant to at least one of the above claims,
characterized in that
tracing of the contour with the image processing sensor occurs in transmitted light or
incident light, wherein simultaneously the measurement with the opto-tactile sensor
is performed alternatively in transmitted light or incident light.

28. Method pursuant to at least one of the above claims,
characterized in that
a scanning direction of the opto-tactile feeler required for a feeler sphere correction
is generated from the image processing contour tracing.

29. Method pursuant to at least one of the above claims,

characterized in that

the image processing windows used for contour tracing overlap.

30. Method pursuant to at least one of the above claims,

characterized in that

contour tracing is performed using an image processing scanner, and at a previously defined distance to the contour traced in this way, the height of the measurement object is captured using another distance sensor.

31. Method pursuant to at least one of the above claims,

characterized in that

the image processing sensors are focused on the basis of a measuring reading determined with a distance sensor.

32. Method pursuant to at least one of the above claims,

characterized in that

a laser distance sensor is used as the distance sensor.

33. Method pursuant to at least one of the above claims,

characterized in that

the laser distance sensor is integrated in the optical beam path of the image processing sensor.

34. Method for scanning workpiece contours,

characterized in that

first a contour in one plane is scanned using a sensor and then the third coordinate to said contour or a contour offset thereto is scanned using another sensor, wherein the measuring points of the first contour define the travel paths.

35. Method for scanning a contour using distance sensors,

characterized in that

in advance a scanning plane is defined in workpiece coordinates and the distance sensor travels in said plane such that the distance value is a constant, wherein the method is not performed in the direction of the axis of the sensor.